BROCKTON CONTRIBUTORY RETIREMENT SYSTEM

ACTUARIAL VALUATION as of January 1, 2020

KMS Actuaries, LLC
52 Hunt Road
Kingston, NH 03848

September, 2020

ACTUARIES

September 15, 2020

Brockton Contributory Retirement Board
1322 Belmont Street
Suite 101
Brockton, MA 02301

Dear Board Members:

We are pleased to present the enclosed report providing the results of our actuarial valuation of the Brockton Contributory Retirement System as of January 1, 2020. Our valuation was performed in accordance with the provisions contained in Chapter 32 of the Massachusetts General Laws, "M.G.L.", as of January 1, 2020. Disclosures under GASB Statement No. 67, Financial Reporting for Pension Plans (GASB 67) and GASB Statement No. 68, Accounting and Financial Reporting for Pensions (GASB 68) are provided in a separate report.

The principal results of our valuation are summarized in Section 2. The Summary of Plan Provisions and Actuarial Assumptions and Methods are shown in Sections 5 and 6, respectively. Section 7 summarizes the demographic profile of active members, retired plan members and beneficiaries and disabled plan members. Asset information and actuarial liabilities are presented in Section 2. The development of the required appropriations pursuant to Chapter 32 of the M.G.L. is shown in Section 3, including a 30-year forecast of the required appropriations and projected cash flows. Section 4 includes a summary of valuation information for PERAC as well as information relating to the primary risks to the System and an assessment of those risks.

This valuation is based upon member data provided by the Brockton Contributory Retirement Board and asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Retirement Board. Although we did not audit the data used in the valuation, we believe that the information is complete and reliable.

Liabilities presented in this report are based on a long-term investment return rate assumption of 7.75%, net of investment expense, compounded annually.

This report was completed in accordance with generally accepted actuarial standards and procedures, and conforms to the Code of Professional Conduct of the American Academy of Actuaries. The actuarial assumptions used in the determination of costs are reasonably related to the experience of the System and to reasonable expectations, and represent our best estimate of anticipated long-term experience under the System.

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Future actuarial valuation results may differ significantly from the current results presented in this report. Examples of potential sources of volatility include plan experience differing from that anticipated by the economic or demographic assumptions, the effect of new entrants, changes in economic or demographic assumptions, the effect of law changes and the delayed effect of smoothing techniques.

Our valuation follows generally accepted actuarial methods and we perform such tests as we consider necessary to assure the accuracy of the results. The amounts presented in this report have been appropriately determined according to the actuarial assumptions and methods stated herein.

This report is intended for the sole use of the Brockton Contributory Retirement Board and is intended to provide information to comply with the stated purpose of the report. It may not be appropriate for other purposes.

The undersigned credentialed actuaries are Members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries necessary to render the actuarial opinion contained herein. They are available to answer any questions with regard to this report.

Respectfully submitted,

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SECTION 1 - EXECUTIVE SUMMARY

Background

We have completed the Actuarial Valuation of the Brockton Contributory Retirement System as of January 1, 2020. This valuation is based upon census data provided by the Retirement Board and asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Brockton Contributory Retirement Board. Information for the prior valuation completed as of January 1, 2018 was obtained from the valuation report prepared by KMS Actuaries.

Massachusetts General Laws

The valuation was prepared in accordance with Chapter 32 of the Massachusetts General Laws ("M.G.L."). The results are based on the active, inactive and retired members and beneficiaries as of December 31, 2019, the assets as of December 31, 2019 and assumptions regarding investment returns, salary increases, mortality, turnover, disability and retirement.

The valuation does not take into consideration:

- Changes in the law after the valuation date,
- Transfers between retirement systems pursuant to Section 3(8)(c) of Chapter 32,
- State-mandated benefits and
- Cost-of-living increases granted to members in pay status between 1982 and 1997.

GASB Statement Numbers 67 and 68

In June 2012, the GASB approved two related Statements that significantly changed the way pension plans and governments account and report pension liabilities. Effective for plans with fiscal years beginning after June 15, 2013, GASB Statement No. 67, Financial Reporting for Pension Plans, replaced the requirements of Statement No. 25 and effective for employers with fiscal years beginning after June 15, 2014, GASB Statement No. 68, Accounting and Financial Reporting for Pensions, replaced the requirements of Statement No. 27.

The pension standards reflect changes from those previously in place regarding how governments calculate total pension liability and pension expense. Further, the standards contain requirements for disclosing information in the notes to financial statements and presenting required supplementary information following the notes.

The required disclosures and notes under GASB Statement Number 67 and 68 for the fiscal year ending December 31, 2019 are provided in a separate report.

Assets

This valuation is based upon asset information reported to the Public Employee Retirement Administration Commission (PERAC) by the Brockton Contributory Retirement Board. The market value of assets increased from $418,078,642 as of December 31, 2017 to $437,753,909 as of December 31, 2019. During the plan years ended 2018 and 2019, the market value rates of return were -5.20% and 17.92%, respectively.

The actuarial value of assets increased from $411,711,574 as of January 1, 2018 to $435,232,670 as of January 1, 2020. During the plan years ended 2018 and 2019, the rates of return on the actuarial value of assets were 4.30% and 5.51%, respectively.

Changes Since the Last Valuation

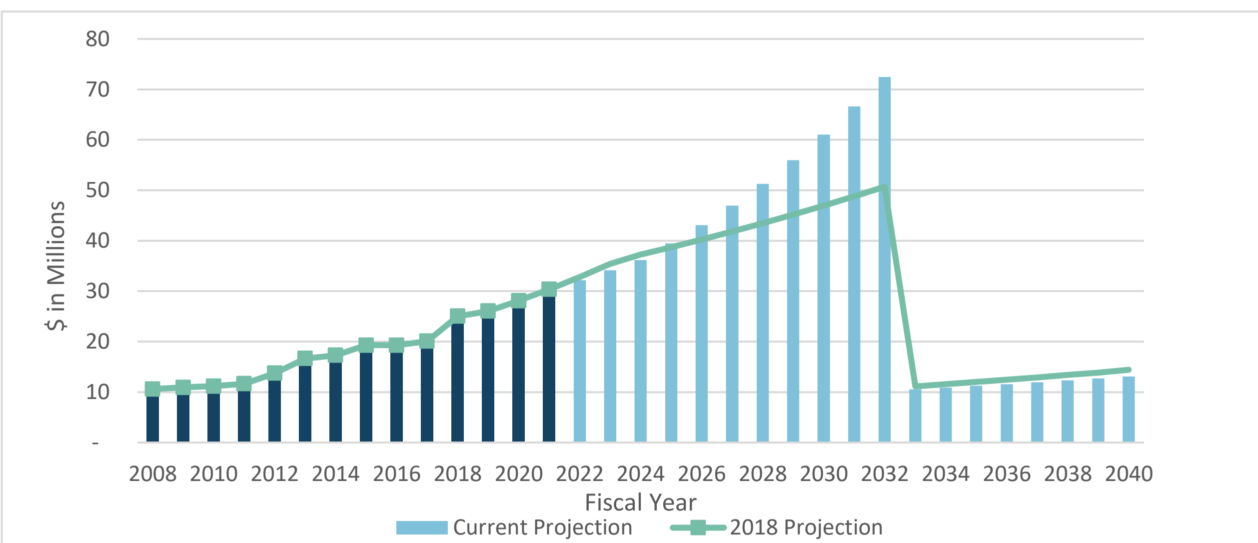
During the two years since the last valuation, the total unfunded actuarial accrued liability of the System was expected to decrease from $247,573,799 as of January 1, 2018 to $236,247,949 as of January 1, 2020, for a total decrease of $11,325,850. The actual unfunded actuarial accrued liability, before any assumption or plan changes, was $267,951,380, resulting in an actuarial loss of $31,703,431. The actuarial loss was primarily due to an asset loss of approximately $24,479,000 and a demographic experience loss of approximately $7,225,000. The details of the gain and loss analysis are provided in Section 2, Actuarial Experience.

Appropriations

The funding appropriation for each year is computed as the sum of the normal cost, net 3(8)(c) transfers and an amortization payment to pay off the Unfunded Actuarial Liability, adjusted for annual payments of the appropriation made July 1. The appropriation calculated as of the January 1, 2020 valuation is $35,553,134, and is made up of a normal cost payment of $5,960,545, net 3(8)(c) transfers of $1,156,039, and an amortization payment of $28,436,550. The amortization method is an increasing amortization of the unfunded actuarial accrued liability at 4% over 12 years and is expected to fully pay the unfunded actuarial accrued liability by the year 2032. The development of the appropriation as of January 1, 2020 is presented in Section 3, Annual Appropriations.

For fiscal year 2021, we show the actual appropriation developed under the previous funding schedule and reported on the PERAC "Required Fiscal Year 2021 Appropriation" letter dated November 12, 2019 of $30,360,986. For fiscal year 2022, we developed an annual appropriation of $32,182,645, which is made up of a normal cost of $6,403,759, net 3(8)(c) transfers of $1,200,000 and payment toward the unfunded actuarial accrued liability of $24,578,886. The unfunded actuarial accrued liability is expected to be fully paid by 2032. The Board adopted a schedule that limits the annual increase in appropriation to 6% for FY2022 through FY2024 and 9.12% thereafter. The current funding schedule is shown in Section 3, Exhibit 3.1.

The chart below shows the historical (navy bars) and projected (blue bars) annual appropriations compared to the projected amounts shown in the prior valuation and funding schedule (green line).



Plan Provisions

All Plan provisions used in this valuation are the same as those used in the prior valuation, except the COLA base was increased from $12,000 to $13,000 effective July 1, 2021, and increased to $14,000 effective July 1, 2022. Increasing the COLA base resulted in a net increase in the unfunded actuarial accrued liability of $5,353,051 and an increase in the employer normal cost of $99,860. The Plan provisions used in this valuation are summarized in Section 5, Summary of Plan Provisions.

Actuarial Assumptions and Methods

Some Actuarial Assumptions and Methods used in this valuation have changed since the last valuation, including decreasing the payroll growth rate from 4.0% to 3.5%, increasing 3(8)(c) transfers from $850,000 to $1,200,000, and updating the mortality and mortality improvement rates. Changing these assumptions resulted in a net increase in the unfunded actuarial accrued liability of $9,631,778 and a decrease in the employer normal cost of $14,025. The Actuarial Assumptions and Methods utilized in this valuation are detailed in Section 6, Actuarial Assumptions and Methods.

Census Data

As of January 1, 2020, there are 1,779 active members who may be eligible for benefits in the future, 1,097 retirees and beneficiaries, 699 inactives and 196 disabled retirees. Summaries of the active, retired and disabled employees are included in Section 7, Plan Member Information.

SECTION 1 - EXECUTIVE SUMMARY

A summary of principal valuation results from the current valuation and the prior valuation follows.

Valuation Date	January 1, 2020	January 1, 2018	% Change
Census Data			
Active Members	1,779	1,731	2.8%
Valuation Salary	$105,044,030	$96,075,528	9.3%
Average Salary	$59,047	$55,503	6.4%
Retired Members and Beneficiaries	1,097	1,099	(0.2%)
Total Annual Retirement Allowance	$35,366,053	$32,610,918	8.4%
Average Annual Retirement Allowance	$32,239	$29,673	8.6%
Disabled Members	196	185	5.9%
Total Annual Retirement Allowance	$9,438,274	$8,566,021	10.2%
Average Annual Retirement Allowance	$48,154	$46,303	4.0%
Inactive Members	699	587	19.1%
Annuity Savings Fund	$4,426,676	$3,077,448	43.8%
Funded Status			
Actuarial Accrued Liability (AAL)	$718,168,879	$659,285,373	8.9%
Market Value of Assets (MVA)	$437,753,909	$418,078,642	4.7%
Unfunded Accrued Liability on MVA	$280,414,970	$241,206,731	16.3%
Funded Status on MVA	61.0%	63.4%	(3.8%)
Actuarial Value of Assets (AVA)	$435,232,670	$411,711,574	5.7%
Unfunded Accrued Liability on AVA	$282,936,209	$247,573,799	14.3%
Funded Status on AVA	60.6%	62.4%	(2.9%)
Appropriations			
Fiscal Year 2020	N/A	$28,112,024	N/A
Fiscal Year 2021	$30,360,986	$30,360,986	0.0%
Fiscal Year 2022	$32,182,645	$32,789,865	(1.9%)
Fiscal Year 2023	$34,113,604	$35,413,054	(3.7%)

Market Value of Assets

Asset information is reported annually to the Public Employee Retirement Administration Commission by the Brockton Contributory Retirement Board. The Market Value of Assets for the three most recent calendar years are as follows:

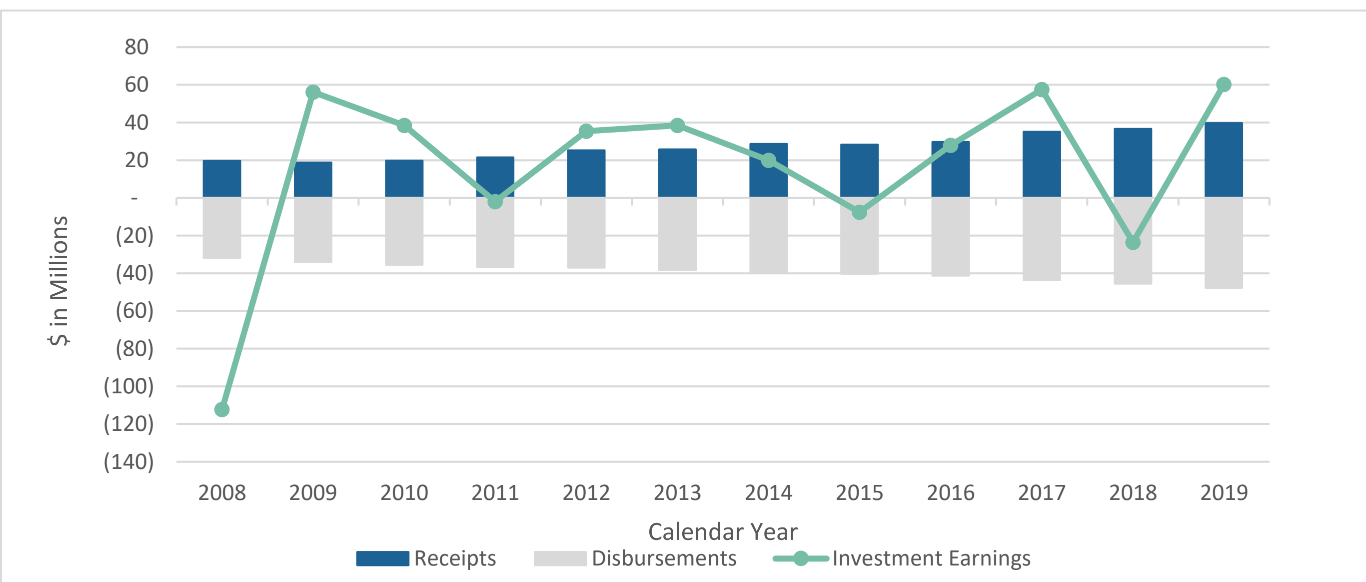
Calendar Year	2019	2018	2017
Trust Fund Composition at Year-End			
Cash	$1,477,338	$13,066,487	$12,159,012
Short-Term Investments	0	0	0
Fixed Income Securities	0	0	0
Equities	13,370	10,356	10,464
Pooled Short Term Funds	0	0	0
Pooled Domestic Equity Funds	87,816,767	72,598,728	104,970,157
Pooled International Equity Funds	27,259,494	134,324,472	136,367,575
Pooled Global Equity Funds	154,344,211	0	0
Pooled Domestic Fixed Income Funds	62,539,786	59,696,959	57,864,857
Pooled International Fixed Income Funds	24,852,603	20,987,029	21,962,731
Pooled Global Fixed Income Funds	0	0	0
Pooled Alternative Investments	40,721,956	47,980,392	43,784,284
Pooled Real Estate Funds	22,174,954	21,896,245	25,823,832
Pooled Domestic Balanced Funds	16,238,992	14,747,654	14,958,270
Pooled International Balanced Funds	0	0	0
Hedge Funds	0	0	0
PRIT Cash	0	0	0
PRIT Fund	0	0	0
Interest Due & Accrued	184,486	134,189	160,568
Prepaid Expenses	916	916	916
Accounts Receivable	163,042	169,320	169,502
Land	0	0	0
Buildings	0	0	0
Accumulated Depreciation - Buildings	0	0	0
Accounts Payable	(34,006)	(21,222)	(153,526)
Total Market Value of Assets	**$437,753,909**	**$385,591,525**	**$418,078,642**

SECTION 2 - PRINCIPAL VALUATION RESULTS

Market Value of Assets

Calendar Year	2019	2018	2017
Funds			
Annuity Savings Fund	$103,271,133	$100,431,548	$96,020,985
Annuity Reserve Fund	27,141,105	25,946,858	26,915,744
Special Military Service Fund	100,143	100,043	102,108
Pension Fund	31,293,446	28,645,537	25,990,340
Expense Fund	0	0	0
Pension Reserve Fund	275,948,082	230,467,539	269,049,465
Total Market Value of Assets	**$437,753,909**	**$385,591,525**	**$418,078,642**
Asset Activity			
Market Value as of Beginning of Year	$385,591,525	$418,078,642	$368,920,617
Contributions and Receipts	39,688,559	36,629,384	35,130,253
Benefit Payments and Expenses	(47,748,272)	(45,489,061)	(43,543,295)
Investment Return	60,222,097	(23,627,440)	57,571,067
Total Market Value of Assets	**$437,753,909**	**$385,591,525**	**$418,078,642**
Rate of Return	17.92%	-5.20%	16.50%

Below are the receipts and disbursements during the last 12 years. The green line reflects investment earnings, which vacillate as investment markets fluctuate. Blue bars indicate contributions, from employees and employers, and grey bars show benefit payments and administrative expenses.



Actuarial Value of Assets

The Actuarial Value of Assets is the market value of assets as of the valuation date adjusted to phase in investment gains and losses over a 5-year period, further constrained to be within 20% of the market value of assets. Investment gains and losses are the excess or deficiency of the expected returns over the actual returns.

Valuation Date	January 1, 2020	January 1, 2019	January 1, 2018
1. Expected Market Value of Assets			
a. Market Value of Assets as of prior January 1	$385,591,525	$418,078,642	$368,920,617
b. Prior Year Contributions and Receipts	39,688,559	36,629,384	35,130,253
c. Prior Year Benefit Payments and Expenses	(47,748,272)	(45,489,061)	(43,543,295)
d. Expected Investment Return Rate	7.75%	7.75%	8.00%
e. Expected Investment Return	29,571,029	32,057,782	29,177,128
f. Expected Market Value of Assets	$407,102,841	$441,276,747	$389,684,703
2. Prior Year Gain/(Loss)			
a. Market Value of Assets as of January 1	$437,753,909	$385,591,525	$418,078,642
b. Expected Market Value of Assets	407,102,841	441,276,747	389,684,703
c. Prior Year Gain /(Loss)	$30,651,068	($55,685,222)	$28,393,939

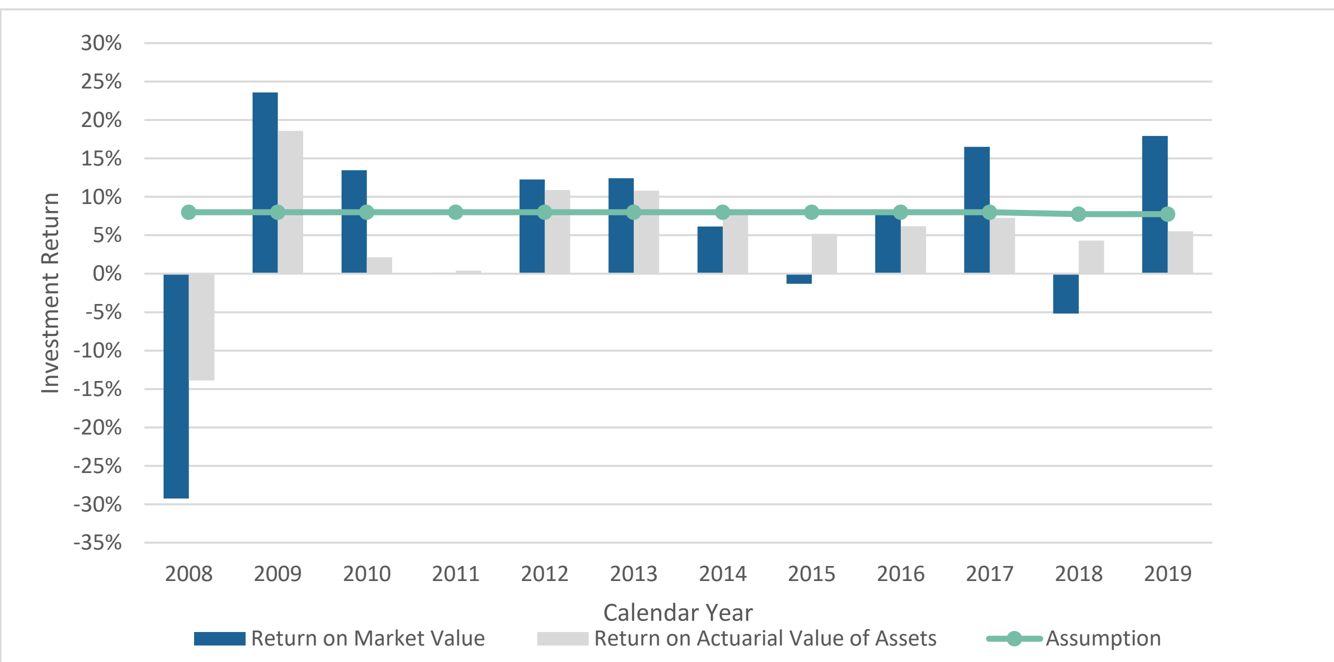
3. Phase-In of Asset Gains and Losses

	Calendar Year	Gain / (Loss)	Unrecognized Gain / (Loss)	Unrecognized Gain / (Loss)	Unrecognized Gain / (Loss)
a.	2019	$30,651,068	$24,520,854	$0	$0
b.	2018	(55,685,222)	(33,411,133)	(44,548,178)	0
c.	2017	28,393,939	11,357,576	17,036,363	22,715,151
d.	2016	269,710	53,942	107,884	161,826
e.	2015	(36,835,382)	0	(7,367,076)	(14,734,153)
f.	2014	(8,878,778)	0	0	(1,775,756)
g.	Total Deferred Gains/(Losses)		$2,521,239	($34,771,007)	$6,367,068

Actuarial Value of Assets

Valuation Date	January 1, 2020	January 1, 2019	January 1, 2018
4. Actuarial Value of Assets			
a. Market Value of Assets	$437,753,909	$385,591,525	$418,078,642
b. Deferred Gains/(Losses)	2,521,239	(34,771,007)	6,367,068
c. Market Value of Assets Less Deferred Gains/(Losses)	$435,232,670	$420,362,532	$411,711,574
d. 80% of Market Value of Assets	350,203,127	308,473,220	334,462,914
e. 120% of Market Value of Assets	525,304,691	462,709,830	501,694,370
f. Actuarial Value of Assets, a., but not less than b. and not greater than c.	$435,232,670	$420,362,532	$411,711,574
g. Ratio of Actuarial Value of Assets to Market Value of Assets	99.4%	109.0%	98.5%
5. Rate of Return on Actuarial Value of Assets for Prior Calendar Year	5.51%	4.30%	7.26%

Below are the investment returns during the last 12 years. The green line reflects the investment return actuarial assumption. Blue bars indicate investment return rates on market value of assets, and grey bars show investment return rates on actuarial value of assets.



SECTION 2 - PRINCIPAL VALUATION RESULTS

Actuarial Liabilities

The **Actuarial Present Value of Future Benefits** is the present value of the cost to finance all benefits payable in the future, discounted to reflect the probability of payment and the time value of money. Below is the Actuarial Present Value of Future Benefits from the current valuation and the prior valuation:

Valuation Date	January 1, 2020	January 1, 2018
Actives	$429,487,781	$405,212,830
Retired Members and Beneficiaries	320,288,694	291,269,266
Disabled Members	98,122,668	82,990,359
Inactive Members	4,426,676	3,077,448
Total Present Value of Future Benefits	**$852,325,819**	**$782,549,903**

The **Actuarial Accrued Liability** is the portion of the Actuarial Present Value of Future Benefits which is allocated to all periods prior to a valuation year and therefore is not provided for by future Normal Costs. Below is the Actuarial Accrued Liability from the current valuation and the prior valuation:

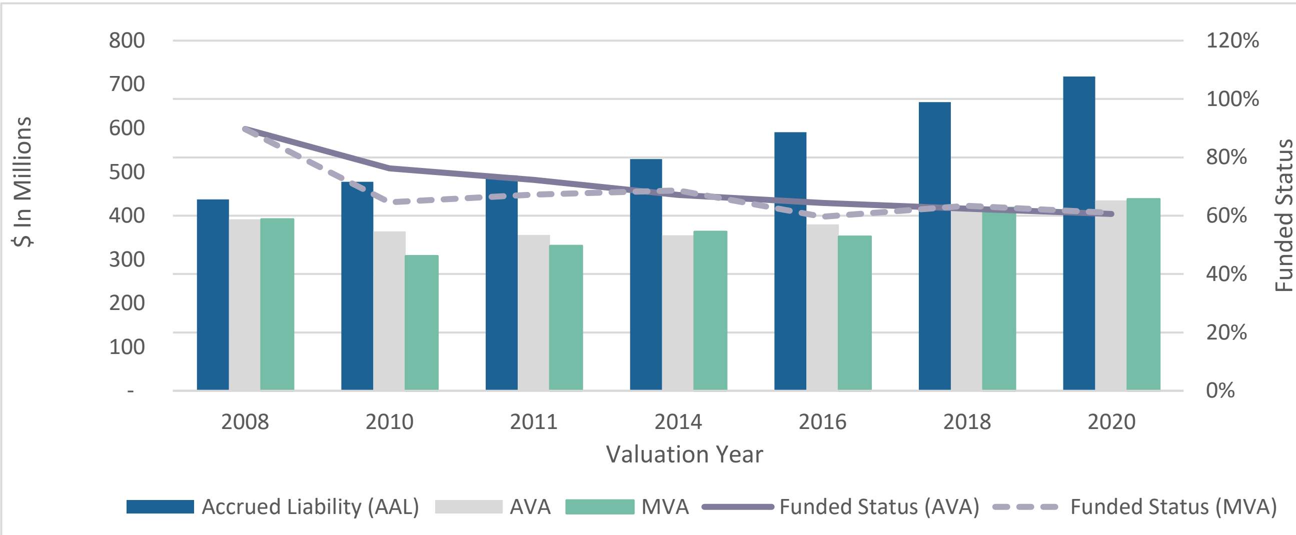
Valuation Date	January 1, 2020	January 1, 2018
Actives	$295,330,841	$281,948,300
Retired Members and Beneficiaries	320,288,694	291,269,266
Disabled Members	98,122,668	82,990,359
Inactive Members	4,426,676	3,077,448
Total Actuarial Accrued Liability	**$718,168,879**	**$659,285,373**

The **Unfunded Actuarial Accrued Liability** is the difference between the Actuarial Accrued Liability and the Actuarial Value of Assets as of the valuation date. The **Funded Status** is the Actuarial Value of Assets divided by the Actuarial Accrued Liability and is a point-in-time measurement of the amount of assets set aside to cover actuarial accrued liabilities. Below is the Unfunded Actuarial Accrued Liability and Funded Status from the current valuation and the prior valuation:

Valuation Date		January 1, 2020	January 1, 2018
Unfunded Actuarial Accrued Liability			
a.	Actuarial Accrued Liability	$718,168,879	$659,285,373
b.	Actuarial Value of Assets	435,232,670	411,711,574
c.	Unfunded Actuarial Accrued Liability (a. - b.)	$282,936,209	$247,573,799
d.	Funded Status (b. divided by a.)	60.6%	62.4%

Actuarial Liabilities

Below are the accrued liabilities, asset values (actuarial and market) and funded status for each of the last 7 valuations. The purple solid line reflects the funded status on an actuarial value of assets (AVA) basis and the purple dotted line reflects the funded status on a market value (MVA) basis. Blue bars indicate actuarial accrued liabilities, grey bars indicate actuarial value of assets and green bars indicate market value of assets.



The **Normal Cost** is the portion of the Actuarial Present Value of Future Benefits which is allocated to a valuation year. Only active employees who have not reached Normal Retirement Age incur a Normal Cost. Below is the Normal Cost from the current valuation and the prior valuation:

Valuation Date	January 1, 2020	January 1, 2018
Total Normal Cost	$15,082,781	$13,935,456
As of Percentage of Salary	14.4%	14.5%
Employee Normal Cost	$9,878,478	$8,965,309
As of Percentage of Salary	9.4%	9.3%
Administrative Expenses	$756,242	$756,242
As a Percentage of Salary	0.7%	0.8%
Net Employer Normal Cost	$5,960,545	$5,726,389
As a Percentage of Salary	5.7%	6.0%

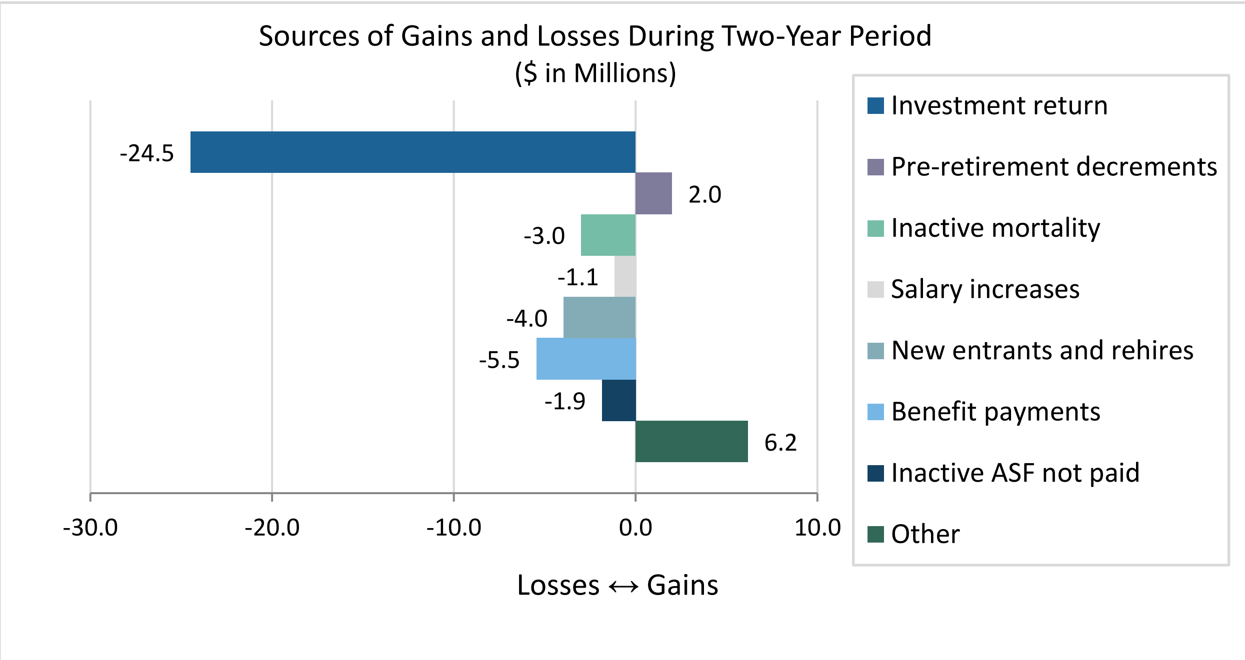
Actuarial Experience

In performing the actuarial valuation, various assumptions are made regarding mortality, retirement, disability and withdrawal rates as well as salary increases and investment returns. A comparison of the results of the current valuation and the prior valuation is made to determine how closely actual experience relates to expected. During the two years since the last valuation, the total unfunded actuarial accrued liability of the System was expected to decrease by $11,325,850. Below is the development of the Actuarial Loss for the current 2-year period:

Calendar Year Ending	December 31, 2019	December 31, 2018
Expected Unfunded Actuarial Accrued Liability		
1. Unfunded Actuarial Accrued Liability, Beginning of Year	$243,727,450	$247,573,799
2. Normal Cost, Beginning of Year	13,789,432	13,935,456
3. Total Contributions	39,688,559	36,629,384
4. Interest (full year on 1. and 2., one-half year on 3.)	18,419,627	18,847,579
5. Expected Unfunded Actuarial Accrued Liability	$236,247,949	$243,727,450
6. Unfunded Actuarial Accrued Liability (before changes)	267,951,380	
7. (Gain)/Loss (6. - 5.)	$31,703,431	
Asset Gain/(Loss)		
1. Actuarial Value of Assets, Beginning of Year	$420,362,532	$411,711,574
2. Contributions and Receipts	39,688,559	36,629,384
3. Benefit Payments and Expenses	(47,748,272)	(45,489,061)
4. Assumed Rate of Return (prior valuation)	7.75%	7.75%
5. Expected Return	32,265,782	31,564,335
6. Actuarial Value of Assets, End of Year	$435,232,670	$420,362,532
7. Actual Return	22,929,851	17,510,635
8. Actual Rate of Return	5.51%	4.30%
9. Asset Gain/(Loss) (7. - 5.)	(9,335,931)	(14,053,700)
10. Total Asset Gain/(Loss), 2-Year Period	($24,478,793)	

Actuarial Experience

Below are the various sources of gains and losses over the 2-year period. The asset loss during the period was $24,478,793, and the total demographic loss during the period was $7,224,638, which totals to an overall loss of $31,703,431.



Unfunded Actuarial Accrued Liability

1.	Changes due to:	
	a. Asset Loss	$24,478,793
	b. Demographic Experience Loss	7,224,638
	c. Total Loss Prior to Changes	31,703,431
	d. Plan Change - COLA Base Increase	5,353,051
	e. Assumption Change - Change in Mortality and Mortality Improvement Rates	9,631,778
	f. Total Increase (including changes)	46,688,260
2.	Unfunded Actuarial Accrued Liability, End of Year	$282,936,209

SECTION 3 - CHAPTER 32 OF M.G.L. APPROPRIATIONS

Annual Appropriations

The Annual Appropriation is determined in accordance with the requirements set forth in Sections 22D and 22F of Chapter 32 of the Massachusetts General Laws ("M.G.L."). The appropriation is comprised of the annual employer normal cost and amortization payments to pay the unfunded actuarial accrued liability. Below are the details of the annual appropriations for the current and prior valuations, adjusted for annual payments made July 1. The appropriations shown are based on the results of the valuation and do not account for any adjustments made to appropriations in the selected funding schedule.

	Valuation Date	January 1, 2020	January 1, 2018
1.	Early Retirement Incentive Plan (1992)		
	Fully Funded Year	2019	2019
	Investment Return Rate	7.75%	7.75%
	Balance as of Valuation Date	$0	$69,784
	Amortization Amount	$0	$69,784
	Increasing Rate	0.00%	0.00%
	Remaining Payment Period from Valuation Date	0	1
2.	Unfunded Actuarial Accrued Liability		
	Fully Funded Year	2032	2032
	Balance as of Valuation Date	$282,936,209	$247,504,015
	Amortization Amount	$28,436,550	$22,030,850
	Increasing Rate	4.00%	4.00%
	Remaining Payment Period from Valuation Date	12	14
3.	Total Amortization Payments	$28,436,550	$22,100,634
4.	Normal Cost	$5,960,545	$5,726,389
5.	Net 3(8)(c) Transfers	$1,156,039	$818,861
6.	Total Appropriation as of January 1	$35,553,134	$28,645,884
7.	**Adjusted for Annual Payments as of July 1**	**$36,905,113**	**$29,735,200**

Exhibit 3.1 - 30-Year Forecast of Annual Appropriations

Fiscal Year Ending	Employer Normal Cost	Amortization Payment of UAL	Net 3(8)(c) Transfers	Total Employer Cost	Increase over Prior Year	Unfunded Actuarial Accrued Liability
2021	$6,187,207	$23,323,779	$850,000	$30,360,986		$282,936,209
2022	6,403,759	24,578,886	1,200,000	32,182,645	6.00%	280,653,054
2023	6,627,890	26,285,714	1,200,000	34,113,604	6.00%	276,890,119
2024	6,859,867	28,100,554	1,200,000	36,160,421	6.00%	271,063,823
2025	7,099,961	31,158,289	1,200,000	39,458,250	9.12%	262,902,136
2026	7,348,461	34,508,382	1,200,000	43,056,843	9.12%	250,933,908
2027	7,605,657	38,177,970	1,200,000	46,983,627	9.12%	234,560,655
2028	7,871,855	42,196,679	1,200,000	51,268,534	9.12%	213,109,343
2029	8,147,370	46,596,853	1,200,000	55,944,223	9.12%	185,824,026
2030	8,432,528	51,413,808	1,200,000	61,046,336	9.12%	151,856,597
2031	8,727,667	56,686,095	1,200,000	66,613,762	9.12%	110,256,563
2032	9,033,136	62,239,839	1,200,000	72,472,975	8.80%	59,959,751
2033	9,349,295	-	1,200,000	10,549,295	-85.44%	-
2034	9,676,521	-	1,200,000	10,876,521	3.10%	-
2035	10,015,199	-	1,200,000	11,215,199	3.11%	-
2036	10,365,731	-	1,200,000	11,565,731	3.13%	-
2037	10,728,532	-	1,200,000	11,928,532	3.14%	-
2038	11,104,031	-	1,200,000	12,304,031	3.15%	-
2039	11,492,672	-	1,200,000	12,692,672	3.16%	-
2040	11,894,916	-	1,200,000	13,094,916	3.17%	-
2041	12,311,238	-	1,200,000	13,511,238	3.18%	-
2042	12,742,131	-	1,200,000	13,942,131	3.19%	-
2043	13,188,106	-	1,200,000	14,388,106	3.20%	-
2044	13,649,689	-	1,200,000	14,849,689	3.21%	-
2045	14,127,429	-	1,200,000	15,327,429	3.22%	-
2046	14,621,889	-	1,200,000	15,821,889	3.23%	-
2047	15,133,655	-	1,200,000	16,333,655	3.23%	-
2048	15,663,333	-	1,200,000	16,863,333	3.24%	-
2049	16,211,549	-	1,200,000	17,411,549	3.25%	-
2050	16,778,953	-	1,200,000	17,978,953	3.26%	-

Exhibit 3.2 - 30-Year Forecast of Cash Flow

Calendar Year	Market Value of Assets, BOY	Benefit Payments	Employee Contributions	Employer Contributions	Investment Return	Market Value of Assets, EOY
2020	$437,753,909	$51,571,651	$9,878,478	$29,248,744	$34,959,886	$460,269,366
2021	460,269,366	48,925,124	10,224,225	30,666,491	36,944,058	489,179,016
2022	489,179,016	50,685,896	10,582,073	32,863,890	39,314,357	521,253,440
2023	521,253,440	52,421,613	10,952,446	34,835,723	41,914,387	556,534,383
2024	556,534,383	54,216,641	11,335,782	38,012,740	44,855,030	596,521,294
2025	596,521,294	56,144,757	11,732,534	41,479,502	48,178,724	641,767,297
2026	641,767,297	58,086,395	12,143,173	45,262,433	51,935,052	693,021,560
2027	693,021,560	60,049,452	12,568,184	49,390,367	56,184,042	751,114,701
2028	751,114,701	62,133,031	13,008,070	53,894,768	60,988,704	816,873,212
2029	816,873,212	64,060,563	13,463,352	58,809,971	66,426,510	891,512,482
2030	891,512,482	66,155,367	13,934,569	64,173,440	72,582,068	976,047,192
2031	976,047,192	69,132,359	14,422,279	69,818,007	79,493,401	1,070,648,520
2032	1,070,648,520	72,243,315	14,927,059	10,162,833	82,120,299	1,105,615,396
2033	1,105,615,396	75,494,264	15,449,506	10,478,071	84,769,178	1,140,817,887
2034	1,140,817,887	78,891,506	15,990,239	10,804,342	87,432,920	1,176,153,882
2035	1,176,153,882	82,441,624	16,549,897	11,142,033	90,103,438	1,211,507,626
2036	1,211,507,626	86,151,497	17,129,143	11,491,543	92,771,574	1,246,748,389
2037	1,246,748,389	90,028,314	17,728,663	11,853,286	95,427,004	1,281,729,028
2038	1,281,729,028	94,079,588	18,349,166	12,227,690	98,058,122	1,316,284,418
2039	1,316,284,418	98,313,169	18,991,387	12,615,198	100,651,917	1,350,229,751
2040	1,350,229,751	102,737,262	19,656,086	13,016,268	103,193,844	1,383,358,687
2041	1,383,358,687	107,360,439	20,344,049	13,431,376	105,667,677	1,415,441,350
2042	1,415,441,350	112,191,659	21,056,091	13,861,013	108,055,353	1,446,222,148
2043	1,446,222,148	117,240,284	21,793,054	14,305,687	110,336,808	1,475,417,413
2044	1,475,417,413	122,516,097	22,555,811	14,765,925	112,489,785	1,502,712,837
2045	1,502,712,837	128,029,321	23,345,264	15,242,271	114,489,643	1,527,760,694
2046	1,527,760,694	133,790,640	24,162,348	15,735,289	116,309,133	1,550,176,824
2047	1,550,176,824	139,811,219	25,008,030	16,245,563	117,918,173	1,569,537,371
2048	1,569,537,371	146,102,724	25,883,311	16,773,696	119,283,584	1,585,375,238
2049	1,585,375,238	152,677,347	26,789,227	17,320,314	120,368,823	1,597,176,255

Forecast Notes

Exhibit 3.1:

- The Employer Normal Cost is expected to increase 3.5% per year.
- The Unfunded Actuarial Accrued Liability ("UAL") is computed as of January 1 of each year assuming no future gains or losses.
- The Amortization Payment of UAL is an increasing payment at 4% paid over 12 years through 2032.
- Net 3(8)(c) transfers are a level dollar amount based on the net transfers expected to be paid by the Brockton Contributory Retirement Board during the current year offset by the amount received during the same period.
- Total Employer Cost is the sum of the Employer Normal Cost, net 3(8)(c) transfers and the Amortization of the UAL, all computed as of January 1 of each year and adjusted for annual payments made on July 1.
- For fiscal year 2021, we show the actual appropriation developed under the previous funding schedule of $30,360,986. For fiscal years 2022 and later, the Board has selected a funding schedule that fully amortizes the unfunded actuarial accrued liability by 2032, with annual employer costs limited to increases of 6% for FY2022 through FY2024 and 9.12% thereafter.

Exhibit 3.2:

- Expected benefit payments include payments expected to be made to retired members, beneficiaries, disabled members and active members expected to retire. In addition, expected benefit payments include distribution of the annuity savings fund attributed to inactive members.
- Benefit payments exclude cost-of-living increases granted to members in pay status between 1982 and 1997. In addition, benefit payments are as expected for the first ten years of the forecast, then increase by the greater of 4.5% per year thereafter or the expected future payments for the current population projected by our computer model.
- Calendar year cash flow entries are developed as of each January 1.

4.1 - GASB 67 and GASB 68 Disclosures

In June 2012, the GASB approved two related Statements that significantly changed the way pension plans and governments account and report pension liabilities. Effective for plans with fiscal years beginning after June 15, 2013, GASB Statement No. 67, *Financial Reporting for Pension Plans* , replaced the requirements of Statement No. 25 and effective for employers with fiscal years beginning after June 15, 2014, GASB Statement No. 68, *Accounting and Financial Reporting for Pensions* , replaced the requirements of Statement No. 27.

The pension standards reflect changes from those previously in place regarding how governments calculate total pension liability and pension expense. Further, the standards contain requirements for disclosing information in the notes to financial statements and presenting required supplementary information following the notes.

GASB 67 requires defined benefit pension plans, such as the Brockton Contributory Retirement System, to present a statement of fiduciary net position (pension plan assets) and a statement of changes in fiduciary net position. Further, the statement requires that notes to financial statements include descriptive information such as the types of benefits provided, the classes of plan members covered and the composition of the pension plan's retirement board. Finally, GASB 67 requires pension plans to present in required supplementary information the sources of the changes in the net pension liability and information about the actuarially determined contributions compared with the actual contributions made to the plan and related ratios.

GASB 67 and GASB 68 require projected benefit payments be discounted to their actuarial present value using the single rate that reflects:

(1) a long-term expected rate of return on pension plan investments *to the extent that the pension plan's assets are sufficient to pay benefits and pension plan assets are expected to be invested using a strategy to achieve that return and*

(2) a tax-exempt, high-quality municipal bond rate *to the extent that the conditions for use of the long-term expected rate of return are not met.*

GASB 68 establishes standards for measuring and recognizing liabilities, deferred outflows of resources, deferred inflows of resources and pension expense by state and local governments.

The effective date for GASB 67 is for plan years beginning after June 15, 2013, which is the fiscal year ending December 31, 2014 for the Brockton Contributory Retirement System. The effective date for GASB 68 is for employers' fiscal years beginning after June 15, 2014. The GASB report, submitted under separate cover and prepared as of December 31, 2019 (the measurement date), presents information to assist the Brockton Contributory Retirement Board in providing the required information under GASB 68 to participating employers.

SECTION 4 - DISCLOSURES

4.2 - PERAC Disclosure Information

The most recent actuarial valuation of the System was prepared by KMS Actuaries, LLC as of January 1, 2020.

Normal Cost - Employees	$9,878,478	9.4% of payroll
Normal Cost - Employers	$5,960,545	5.7% of payroll
Actuarial Liability - Active Members	$295,330,841	41% of total AAL
Actuarial Liability - Retired and Inactive Members	422,838,038	59% of total AAL
Total Actuarial Liability (AAL)	$718,168,879	
System Assets	$435,232,670	
Unfunded Actuarial Accrued Liability	$282,936,209	
Funded Status	60.6%	

Principal actuarial assumptions used in the valuation:

Investment Return	7.75%
Rate of Salary Increase	Based on service, 6% graded down to 4.25% for Group 1
	Based on service, 7% graded down to 4.75% for Group 4

4.3 - Risk Measures

The Brockton Contributory Retirement System is subject to certain risks that could affect the plan's future financial condition. Here we identify the primary risks to the System, provide some background information about those risks, and provide an assessment of those risks in accordance with Actuarial Standards of Practice (ASOP) 51.

Risk is the potential of actual future measurements deviating from expected future measurements resulting from actual future experience deviating from actuarially assumed experience. Examples of potential risks that may be reasonably anticipated to significantly affect the future financial condition of the plan include the following:

- **Investment Risk** - the potential that investment returns will be different than expected.
- **Asset/Liability Mismatch Risk** - the potential that changes in asset values are not matched by changes in the value of liabilities.
- **Interest Rate Risk** - the potential that interest rates will be different than expected.
- **Longevity and Other Demographic Risks** - the potential that mortality or other demographic experience will be different than expected.
- **Contribution Risk** - the potential of actual future contributions deviating from expected future contributions. For example, that actual contributions are not made in accordance with the plan's funding policy, that other anticipated payments to the plan are not made, or that material changes occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base.

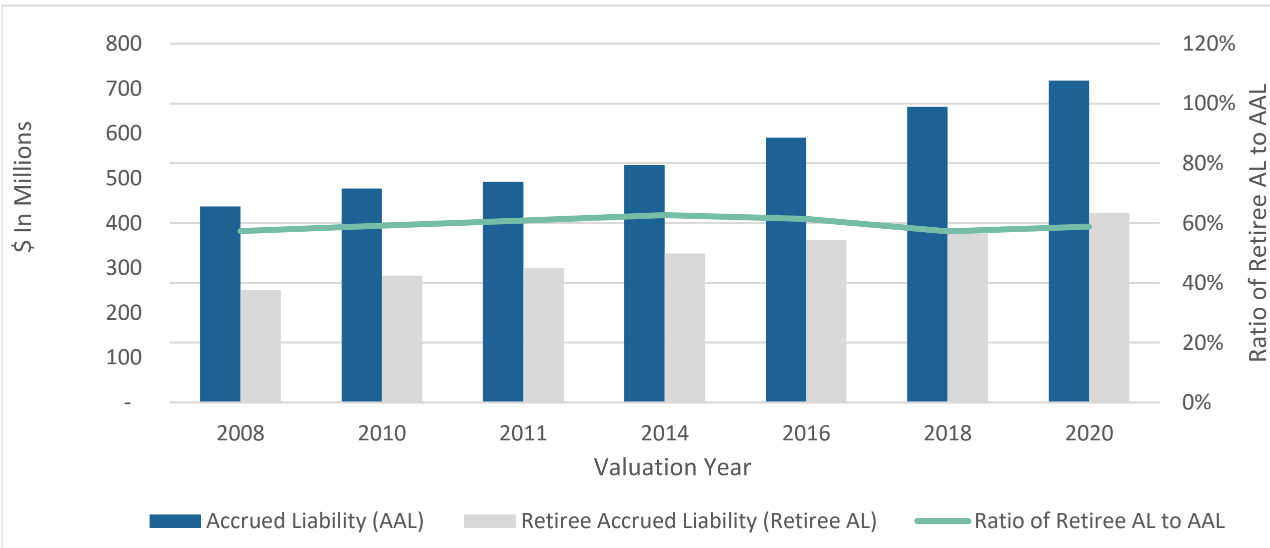
We have provided several risk measures in this section that we believe are most significant for the plan. However, we believe that a more rigorous assessment of risk would be beneficial to the Board to understand the risks identified above, such as:

- Scenario Test - a process for assessing the impact of one possible event, or several simultaneous or sequentially occurring possible events, on a plan's financial condition.
- Sensitivity Test - a process for assessing the impact of a change in an actuarial assumption on an actuarial measurement.
- Stochastic Modeling - a process for generating numerous potential outcomes by allowing for random variations in one or more inputs over time for the purpose of assessing the distribution of those outcomes.
- Stress Test - a process for assessing the impact of adverse changes in one or relatively few factors affecting a plan's financial condition.

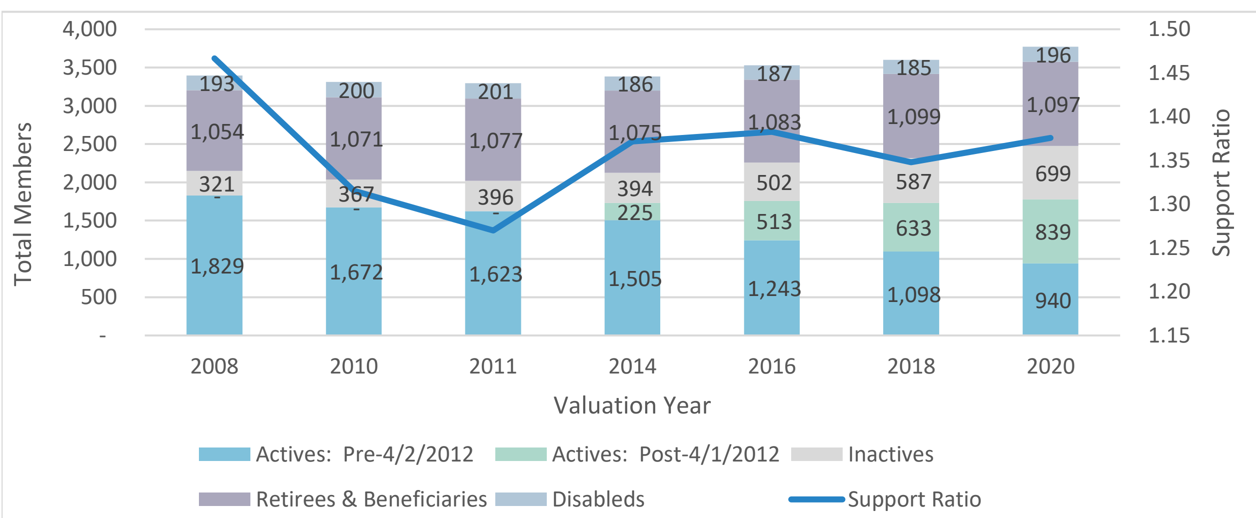
4.3 - Risk Measures

Maturity Measures

As retirement systems mature they become much more sensitive to risks. This is because a higher proportion of the actuarial liability is attributable to participants who are no longer active. Plan maturity measures are helpful in understanding the risks associated with a plan. One such maturity measure is the ratio of the system's retiree liability to its total liabiity. A retirement system in its infancy will have a very low ratio of retiree liability to total liability. As the system matures, the ratio starts increasing. A mature plan will often have a ratio above 60%. For the Brockton Contributory Retirement System and other retirement systems in the United States these ratios have been steadily increasing in recent years.



Another maturity measure is the ratio of actives to retirees, or support ratio. A retirement system in its infancy will have a very high ratio of active to retired members. As the system matures, and members retire, the support ratio starts declining. A mature system will often have a support ratio near or below one.



4.3 - Risk Measures

Volatility Indices

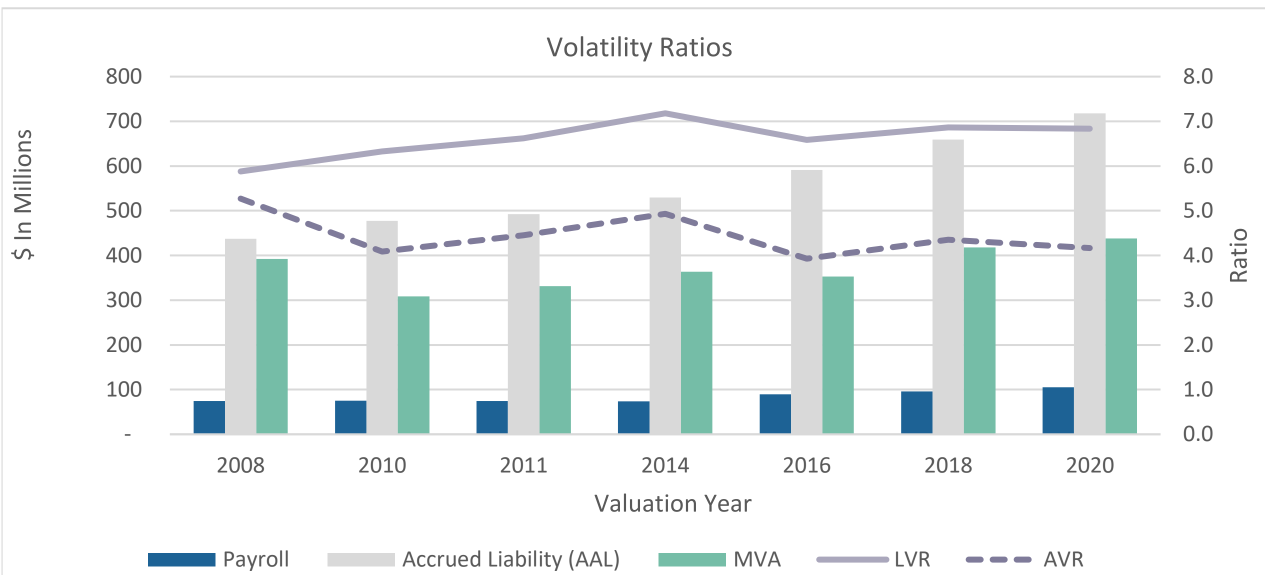
Volatility indices are measures of the relative sensitivity of employer contributions to changes in assets or liabilities. Below we present two such indices - the Asset Volatility Ratio (AVR) and the Liability Volatility Ratio (LVR):

Asset Volatility Ratio (AVR)

The Asset Volatility Ratio (AVR) is the ratio of the Market Value of Assets (MVA) to Payroll. Systems with a higher AVR experience more volatile employer contributions (as a percentage of payroll) due to investment return. This ratio indicates a measure of the system's current contribution volatility. The AVR increases over time but generally tends to stabilize as the system matures.

Liability Volatility Ratio (LVR)

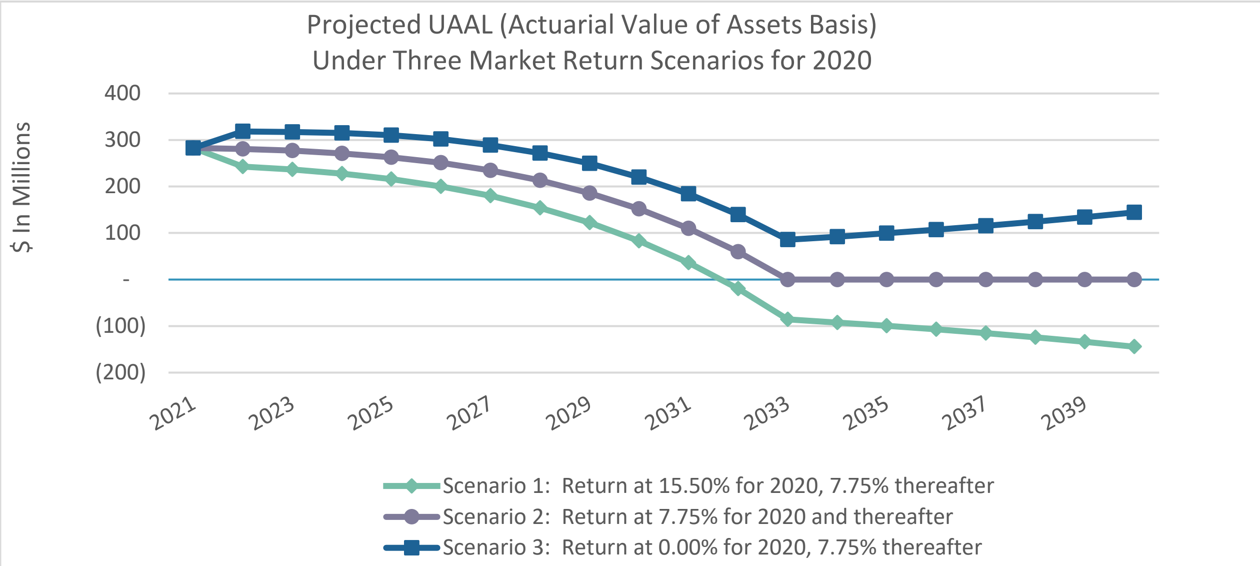
The Liability Volatility Ratio (LVR) is the ratio of the Actuarial Accrued Liability (AAL) to Payroll. Systems with a higher LVR experience more volatile employer contributions (as a percentage of payroll) due to the investment return assumption and changes in liability. This ratio indicates a longer-term potential for contribution volatility. The AVR, described above, will tend to move close to the LVR as the system matures.



4.3 - Risk Measures

Market Return Scenarios

Below we illustrate the projected effect on funding levels of a single year of investment return above or below the assumed investment return. Scenario 1 assumes a one-year return of 2 times the assumed return and the expected return thereafter, Scenario 2 assumes assets earn the expected return every year and Scenario 3 assumes a one-year return of 0% and the expected return thereafter.



Sensitivity Analysis

The following presents the Actuarial Accrued Liability and Funded Status calculated using the investment return rate of 7.75%, as well as what the Actuarial Accrued Liability and Funded Status would be if it were calculated using an investment return rate 1-percentage point lower (6.75%) or 1-percentage point higher (8.75%) than the assumed investment return rate:

	1% Decrease (6.75%)	Current Investment Return Rate (7.75%)	1% Increase (8.75%)
Actuarial Accrued Liability	$796,143,475	$718,168,879	$651,860,415
% Change	11%		-9%
Actuarial Value of Assets	$435,232,670	$435,232,670	$435,232,670
Unfunded Actuarial Accrued Liability	360,910,805	282,936,209	216,627,745
% Change	28%	N/A	-23%
Funded Status	54.7%	60.6%	66.8%

4.3 - Risk Measures

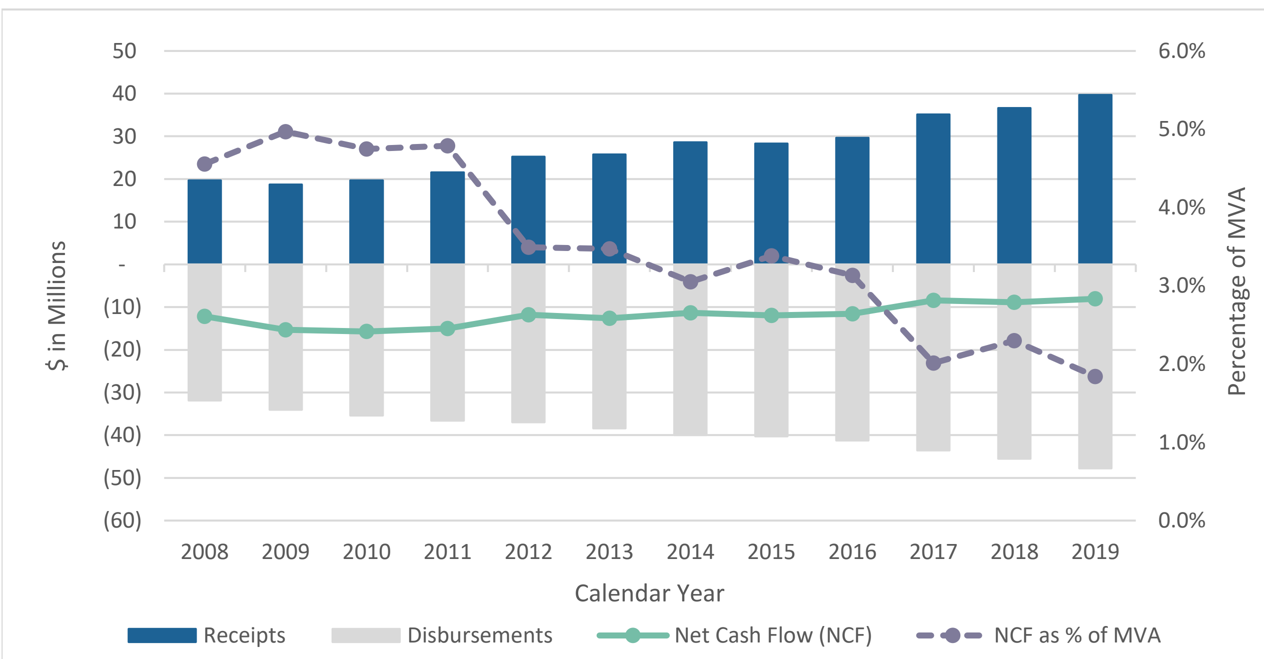
Duration

Duration is another measure that is used to describe how the present value of a cash flow series changes when small changes are made to the underlying interest rates. The duration of the Brockton Contributory Retirement System is 10, and this represents an approximate percentage change in the Actuarial Accrued Liability for each 1% change to the investment return rate.

Net Cash Flow (NCF)

Net cash flow (NCF) during a year is the difference between contributions, both employer and employee, paid into the System and benefit payments and expenses paid from the System. If the level of benefit payments plus expenses is greater than contributions, then the System has negative NCF. Mature plans generally have a negative NCF as the number of retirees grows. When a System has negative NCF, then additional cash from existing assets are needed to pay the pension benefits.

Historical NCF since 2008 is shown in the next graph. Blue bars indicate contributions, from employees and employers, and grey bars show benefit payments and administrative expenses. The NCF is represented by the green line. The dashed purple line (which corresponds to the right-hand axis) provides the NCF as a percentage of the Market Value of Assets. As of December 31, 2019, the NCF was negative $8.1 million, which represents 1.8% of the Market Value of Assets. The NCF falls within the range of 1.8% to 5.0% of total assets over the 12-year period.



SECTION 5 - SUMMARY OF PLAN PROVISIONS

Administration	There are 104 contributory retirement systems for public employees in Massachusetts. Each system is governed by a retirement board and all boards, although operating independently, are governed by Chapter 32 of the Massachusetts General Laws and other applicable statutes. This law in general provides uniform benefits, uniform contribution requirements and a uniform accounting and funds structure for all systems.
Participation	Participation is mandatory for all full-time employees. Eligibility with respect to part-time, provisional, temporary, seasonal or intermittent employment is governed by regulations promulgated by the local retirement board, and approved by PERAC. Membership is optional for certain elected officials.
Membership Groups	There are four membership groups in the Retirement System:

Group 1	General employees, including clerical, administrative, technical and all other employees not otherwise classified.
Group 2	Certain specified hazardous duty positions.
Group 3	State police officers and inspectors.
Group 4	Local police officers, firefighters and other specified hazardous positions.

For members in more than one group, participation will be proportional.

Member Contributions

Member contributions vary depending on the most recent date of membership:

Prior to 1975	5% of Salary
1975 – 1983	7% of Salary
1984 – June 30, 1996	8% of Salary
July 1, 1996 – present	9% of Salary
1979 – present	An additional 2% of Salary in excess of $30,000.
Group 1 members hired on or after April 2, 2012	6% of Salary with 30 or more years of creditable service.

Rate of Interest

Interest on regular deductions made after January 1, 1984 is a rate established by PERAC in consultation with the Commissioner of Banks. The rate is obtained from the average rates paid on individual savings accounts by a representative sample of at least ten financial institutions.

Retirement Age

The mandatory retirement age for some Group 2 and Group 4 members is age 65. Most Group 2 and Group 4 members may remain in service after reaching age 65. Group 4 members who are employed in certain public safety positions are required to retire at age 65. There is no mandatory retirement age for members in Group 1.

Salary

Gross regular compensation. This does not include bonuses, overtime, severance pay, unused sick leave credit or other similar compensation.

Average Salary

Membership before April 2, 2012

- Average annual rate of regular compensation received during the three consecutive years that produce the highest average, or, if greater, during the last three years (whether or not consecutive) preceding retirement.

Membership on or after April 2, 2012

- Average annual rate of regular compensation received during the five consecutive years that produce the highest average, or, if greater, during the last five years (whether or not consecutive) preceding retirement.

Creditable Service

The period during which a member contributes to the retirement system plus certain periods of military service and "purchased" service.

Benefit Rate

The benefit rate varies with the member's retirement age, Group, membership date and years of creditable service at retirement. Each year a member retires prior to the age at which the 2.5% maximum benefit rate applies, a reduction is applied to each year of age under the maximum age. The maximum age and reduction for each Group and membership date is as follows:

	Group 1	Group 2	Group 4
2.5% for Membership before April 2, 2012:			
Maximum age:	65	60	55
Reduction:	0.1%	0.1%	0.1%
2.5% for Membership on or after April 2, 2012 (less than 30 years of service):			
Maximum age:	67	62	57
Reduction:	0.15%	0.15%	0.15%
2.5% for Membership on or after April 2, 2012 (30+ years of service):			
Maximum age:	67	62	57
Reduction:	0.125%	0.125%	0.125%

Superannuation Retirement	Eligibility if membership before April 2, 2012	♦ completion of 20 years of Creditable Service, or ♦ attainment of age 55 if hired prior to 1978, or ♦ attainment of age 55 with 10 years of Creditable Service, if hired after 1978.
	Eligibility if membership on or after April 2, 2012	♦ attainment of age 60 with 10 years of Creditable Service if classified in Group 1 ♦ attainment of age 55 with 10 years of Creditable Service if classified in Group 2 ♦ attainment of age 55 if classified in Group 4
	Benefit Amount	Product of the member's Benefit Rate, Average Salary and Creditable Service.
	Maximum Benefit	80% of the member's Average Salary.
	Veteran's Benefit	Additional benefit of $15 per year of Creditable Service, up to a maximum of $300.
Deferred Vested	Eligibility	♦ completion of ten or more years of Creditable Service. ♦ elected officials hired prior to 1978, completion of six years of Creditable Service.
	Benefit Amount	Accrued benefit payable commencing at age 55, or the completion of 20 years of Creditable Service, or may be deferred until later at the participant's option.
Withdrawal of Contributions		Contributions may be withdrawn upon termination of employment. ♦ Members hired on or after January 1, 1984 who terminate with less than ten years of Creditable Service receive contributions plus interest on the Annuity Savings Account at an annual rate of 3%. ♦ All other withdrawals receive contributions plus 100% of the regular interest that has accrued to the Annuity Savings Account.

Ordinary Disability Retirement	Eligibility	Non-job related disability after completion of ten years of Creditable Service.
	Benefit Amount for Group 1 membership before April 2, 2012 or Group 2 or Group 4	Superannuation benefit determined if the member is age 55, up to a maximum of 80% of Average Salary over three years. If the member is a veteran, 50% of final rate of salary (final year) plus an annuity based on the accumulated member contributions plus credited interest, up to a maximum of 80% of Average Salary over five years.
	Benefit Amount for Group 1 membership on or after April 2, 2012	Superannuation benefit determined if the member is age 60, up to a maximum of 80% of Average Salary over three years. If the member is a veteran, 50% of final rate of salary (final year) plus an annuity based on the accumulated member contributions plus credited interest, up to a maximum of 80% of Average Salary over five years.
Accidental Disability Retirement	Eligibility	Disabled as a result of an accident in the performance of duties. There is no minimum age or service requirement.
	Benefit Amount	72% of Salary plus an annuity based on accumulated member contributions plus credited interest.
	Maximum Benefit	100% of Salary if hired before January 1, 1988, otherwise 75% of Salary.
	Veteran's Benefit	Additional allowance of $15 per year of Creditable Service, up to a maximum of $300.
	Supplemental Dependent Allowance	Additional allowance of $952.32 per year for each child until age 18 (or age 22 if a full-time student).
Non-Occupational Death	Eligibility	For members with at least two years of creditable service who die while in active service, but not due to occupational injury.
	Benefit Amount	Benefit as if Option C had been elected. Minimum benefit of $250 per month for surviving spouse, $120 per month for first child and $90 per month for each additional child.

Accidental Death	Eligibility	For members who die as a result of an occupational injury.
	Benefit Amount	72% of Salary plus an annuity based on accumulated member contributions plus credited interest.
	Maximum Benefit	100% of Salary if hired before January 1, 1988, otherwise 75% of Salary.
	Veteran's Benefit	Additional allowance of $15 per year of creditable service, up to a maximum of $300.
	Supplemental Dependent Allowance	Additional allowance of $312 per year for each child until age 18 (or age 22 if a full-time student).

Cost-of-Living Adjustment (COLA)

In accordance with the adoption of Chapter 17 of the Acts of 1997, the granting of a Cost-of-Living Adjustment will be determined by an annual vote by the Retirement Board. The amount of increase will be based upon the Consumer Price Index, limited to a maximum of 3.0%, beginning on July 1. All retirees, disabled retirees and beneficiaries who have been receiving benefit payments for at least one year as of July 1 are eligible for the adjustment. The maximum amount of pension benefit subject to a COLA is currently $12,000 and will increase to $13,000 effective July 1, 2021 and $14,000 effective July 1, 2022. All COLAs granted to members after 1981 and prior to July 1, 1998 are deemed to be an obligation of the Commonwealth of Massachusetts and are not the liability of the Retirement System.

Optional Forms of Payment

A member may elect to receive his or her retirement allowance, payable in monthly installments, in one of three forms of payment:

♦ Option A – Total annual allowance commencing at retirement and terminating at member's death.

♦ Option B – A reduced annual allowance commencing at retirement with death benefit equal to excess of member contributions plus credited interest to retirement over annuity benefit paid to member.

♦ Option C – A reduced annual allowance commencing at retirement with 66⅔% of benefit continued to designated beneficiary upon death of member. For members who retired on or after January 12, 1988, if the beneficiary pre-deceases the retiree, the benefit payable increases based on the factor used to determine the Option C benefit at retirement. For members who retired prior to January 12, 1988, if the System has accepted Section 288 of Chapter 194 of the Acts of 1998 and the beneficiary pre-deceases the retiree, the benefit payable increases based on the factor used to determine the Option C benefit at retirement.

SECTION 6 - ACTUARIAL ASSUMPTIONS AND METHODS

Valuation Date

January 1, 2020

Investment Return

7.75% per year.

The investment return assumption is a long-term assumption based on capital market expectations by asset class, historical returns and professional judgment. We considered analysis prepared by PRIM's investment advisor using a building block approach and using the target asset allocation, expected returns by asset class and risk analysis to determine a long-term expected average annual rate of return.

Annuity Savings Fund Interest Rate

2.00% per year

Amortization Method

Unfunded Actuarial Accrued Liability (UAL):

Increasing dollar amount at 4% to reduce the Unfunded Actuarial Accrued Liability to zero on or before June 30, 2032. For fiscal years 2022 and later, the Board has selected a funding schedule that fully amortizes the unfunded actuarial accrued liability by 2032, with annual employer costs limited to increases of 6% for FY2022 through FY2024 and 9.12% thereafter.

Salary Scale

The assumed annual rates for salary increases including longevity are illustrated by the following rates:

Years of Service	Groups 1 and 2	Group 4
0	6.00%	7.00%
1	5.50%	6.50%
2	5.50%	6.00%
3	5.25%	5.75%
4	5.25%	5.25%
5	4.75%	5.25%
6	4.75%	4.75%
7	4.50%	4.75%
8	4.50%	4.75%
9+	4.25%	4.75%

The salary scale assumption is a long-term estimate derived from historical data, current and recent market expectations and professional judgment.

Cost-of-Living Allowance

Cost-of-Living Allowances (COLA) are assumed to be 3% of the pension amount capped at a maximum amount of pension benefit of $12,000 and will increase to $13,000 effective July 1, 2021 and $14,000 effective July 1, 2022.

Mortality Rates

RP-2014 Blue Collar Mortality Table with full generational mortality improvement using Scale MP-2018. For disabled members, RP-2014 Blue Collar Mortality Table set forward one year with full generational mortality improvement using Scale MP-2018.

General Employees: 55% of deaths are job-related.

Police and Fire : 90% of deaths are job-related.

PERAC completed a local system retiree mortality study in 2019 and selected the RP-2014 Blue Collar Mortality Table with full generational mortality improvement using Scale MP-2018. The underlying tables with generational mortality improvement selected reasonably reflect the mortality experience of the System as of the valuation date based on historical and current demographic data as well as professional judgement.

Turnover Rates

Illustrative turnover rates are shown below:

Creditable Service	Groups 1 and 2	Group 4
0	0.1500	0.0150
10	0.0540	0.0150
20	0.0200	0.0000
30	0.0000	0.0000

Disability Rates

Illustrative disability rates are shown below:

Attained Age	Groups 1 and 2	Group 4
20	0.0001	0.0010
30	0.0003	0.0030
40	0.0010	0.0030
50	0.0019	0.0125
60	0.0028	0.0085

General Employees: 55% of disabilities are accidental and 45% are ordinary.

Police and Fire : 90% of disabilities are accidental and 10% are ordinary.

Retirement Rates

Illustrative retirement rates are shown below:

Attained Age	Groups 1 and 2		Group 4
	Male	Female	Male & Female
50	0.0100	0.0150	0.0200
51	0.0100	0.0150	0.0200
52	0.0100	0.0200	0.0200
53	0.0100	0.0250	0.0500
54	0.0200	0.0250	0.0750
55	0.0200	0.0550	0.1500
56	0.0250	0.0650	0.1000
57	0.0250	0.0650	0.1000
58	0.0500	0.0650	0.1000
59	0.0650	0.0650	0.1500
60	0.1200	0.0500	0.2000
61	0.2000	0.1300	0.2000
62	0.3000	0.1500	0.2500
63	0.2500	0.1250	0.2500
64	0.2200	0.1800	0.3000
65	0.4000	0.1500	1.0000
66	0.2500	0.2000	1.0000
67	0.2500	0.2000	1.0000
68	0.3000	0.2500	1.0000
69	0.3000	0.2000	1.0000
70	1.0000	1.0000	1.0000

The turnover, disability and retirement rates are based on PERAC's most recent experience analysis of local retirement systems which reviewed age, gender and job group. The assumptions reflect this analysis as well as professional judgment.

Actuarial Cost Method

Individual Entry Age Normal.

Actuarial Asset Method

The Actuarial Value of Assets is the market value of assets as of the valuation date reduced by the sum of:

a) 80% of gains and losses of the prior year,
b) 60% of gains and losses of the second prior year,
c) 40% of gains and losses of the third prior year, and
d) 20% of gains and losses of the fourth prior year.

Investment gains and losses are determined by the excess or deficiency of the expected return over the actual return on the market value. The actuarial valuation of assets is further constrained to be not less than 80% or more than 120% of market value.

Asset Data

Asset information is reported annually to the Public Employee Retirement Administration Commission by the Brockton Contributory Retirement Board.

Dependents

80% of all members will be survived by a spouse. Age assumption for spouses is that males are assumed to be three years older than females.

Net Section 3(8)(c) Transfers

Reimbursements paid to and received from other retirement systems for that portion of a retiree's pension that is based on service earned in another retirement system. Net 3(8)(c) transfers are assumed to be $1,200,000 per year.

Administrative Expenses

The anticipated administrative expenses for the fiscal year. For Fiscal Year 2021, the administrative expenses were assumed to be $785,000 and are anticipated to increase 3.5% per year.

The administrative expense assumption is based on information relating to the System's administrative expenses provided by the Retirement System.

SECTION 7 - PLAN MEMBER INFORMATION

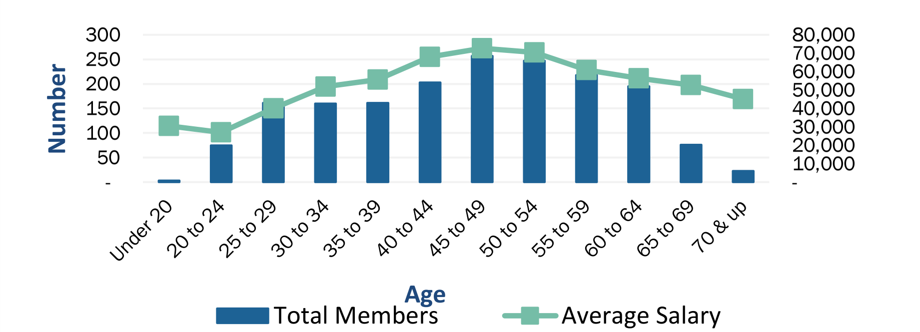
Exhibit 7.1 - Summary of Census Data as of January 1, 2020

Census data as of December 31, 2019 was provided to us by the Retirement Board. We performed edits on the data to ensure that it is reasonable and complete and made certain assumptions regarding any missing or invalid data so that results are not materially affected. Presented on the following pages are summaries of the demographic profile of active members (Exhibit 7.2) and retired plan members and beneficiaries and disabled plan members (Exhibit 7.3). Below, we present a comparison of the census data from the current and prior valuations:

Valuation Date	January 1, 2020	January 1, 2018	% Change
Census Data			
Active Members	1,779	1,731	2.8%
Average Age	46.6	46.9	(0.7%)
Average Service	11.3	11.9	(5.3%)
Valuation Salary	$105,044,030	$96,075,528	9.3%
Average Salary	$59,047	$55,503	6.4%
Retired Members and Beneficiaries	1,097	1,099	(0.2%)
Average Age	75.2	75.0	0.3%
Total Annual Retirement Allowance	$35,366,053	$32,610,918	8.4%
Average Annual Retirement Allowance	$32,239	$29,673	8.6%
State Reimbursed COLAs	$198,752	$213,662	(7.0%)
Total System-Funded Retirement Allowance	$35,167,301	$32,397,256	8.6%
Disabled Members	196	185	5.9%
Average Age	67.2	66.9	0.5%
Total Annual Retirement Allowance	$9,438,274	$8,566,021	10.2%
Average Annual Retirement Allowance	$48,154	$46,303	4.0%
State Reimbursed COLAs	$61,540	$110,564	(44.3%)
Total System-Funded Retirement Allowance	$9,376,734	$8,455,457	10.9%
Inactive Members	699	587	19.1%
Annuity Savings Fund	$4,426,676	$3,077,448	43.8%

Exhibit 7.2 - Active Members by Age and Years of Service as of January 1, 2020

	Years of Service											
Attained Age	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & up	Total	Total Salary	Average Salary
Under 20	3	-	-	-	-	-	-	-	-	3	91,539	30,513
20 to 24	74	1	-	-	-	-	-	-	-	75	2,025,243	27,003
25 to 29	148	13	-	-	-	-	-	-	-	161	6,446,039	40,038
30 to 34	107	39	14	-	-	-	-	-	-	160	8,308,588	51,929
35 to 39	85	37	27	12	-	-	-	-	-	161	8,977,393	55,760
40 to 44	75	39	33	39	17	-	-	-	-	203	13,811,696	68,038
45 to 49	61	43	29	44	64	15	1	-	-	257	18,679,114	72,681
50 to 54	44	42	27	39	57	29	9	-	-	247	17,395,012	70,425
55 to 59	37	33	33	34	45	15	18	3	-	218	13,269,562	60,870
60 to 64	26	23	23	40	54	10	13	6	-	195	10,990,572	56,362
65 to 69	10	6	12	13	18	6	6	2	3	76	4,013,157	52,805
70 & up	2	4	3	5	1	1	3	-	4	23	1,036,115	45,048
Total	672	280	201	226	256	76	50	11	7	1,779	105,044,030	59,047
Average Salary	39,098	52,231	61,006	67,935	85,407	96,112	112,772	103,429	83,576			
					Average Age:		46.6	Average Service:		11.3		



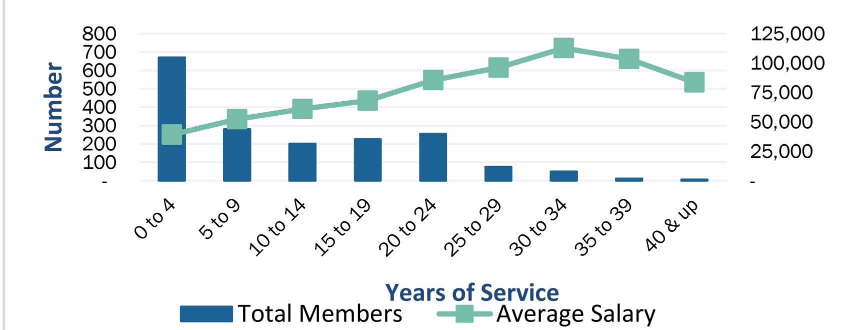
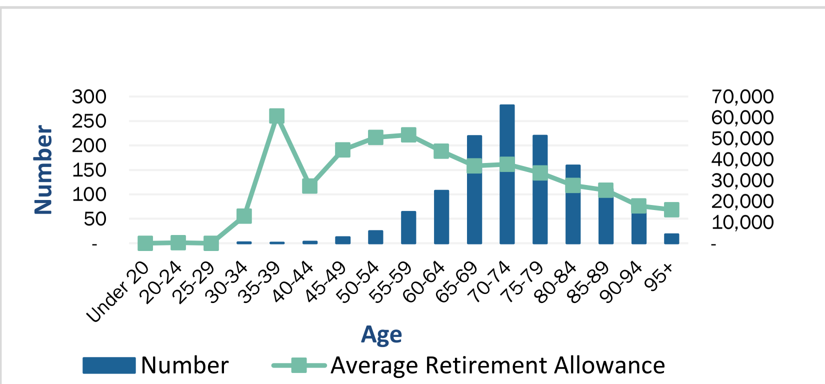
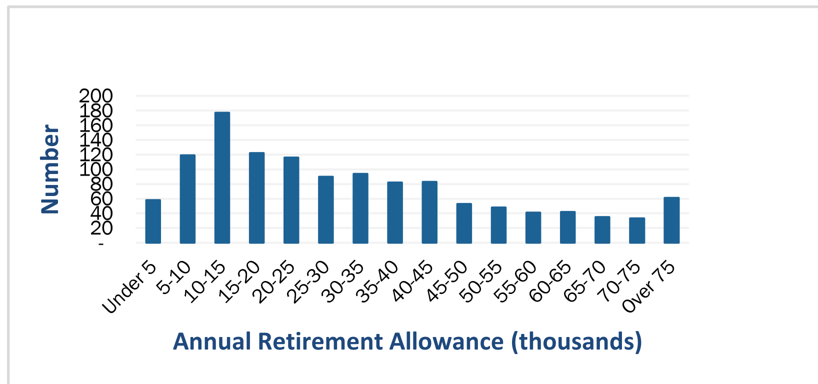


Exhibit 7.3 - Annual Retirement Allowances as of January 1, 2020

Attained Age	Service Retirements Number	Service Retirements Annual Retirement Allowance	Disability Retirements Number	Disability Retirements Annual Retirement Allowance	Beneficiaries Number	Beneficiaries Annual Retirement Allowance
Under 20	0	0	0	0	0	0
20-24	0	0	0	0	1	311
25-29	0	0	0	0	0	0
30-34	0	0	1	15,234	1	10,751
35-39	0	0	1	60,808	0	0
40-44	0	0	2	71,533	1	10,490
45-49	1	32,216	10	447,970	1	55,330
50-54	2	74,588	19	1,078,446	4	109,257
55-59	33	1,710,458	24	1,428,570	7	168,226
60-64	73	3,482,013	21	901,977	13	314,405
65-69	165	6,043,998	31	1,509,316	23	547,228
70-74	217	8,092,080	29	1,474,385	36	1,043,112
75-79	162	5,312,803	29	1,236,150	29	841,012
80-84	117	3,196,934	18	791,888	24	411,840
85-89	77	1,951,452	9	350,308	25	510,645
90-94	43	733,696	2	71,689	24	426,302
95+	11	139,184	0	0	7	147,722
Total	901	30,769,422	196	9,438,274	196	4,596,631
Average Age	74.9		67.2		76.7	
Average Retirement Allowance		34,150		48,154		23,452





Actuarial Accrued Liability – That portion of the Actuarial Present Value of pension plan benefits which is not provided by future Normal Costs or employee contributions. It is the portion of the Actuarial Present Value attributable to service rendered as of the Valuation Date.

Actuarial Assumptions – Assumptions, based upon past experience or standard tables, used to predict the occurrence of future events affecting the commencement, amount and duration of pension benefits, such as: changes in compensation, mortality, withdrawal, disablement and retirement; rates of investment earnings and asset appreciation or depreciation; and any other relevant items.

Actuarial Cost Method (or Funding Method) – A procedure for allocating the Actuarial Present Value of all past and future pension plan benefits to the current year (Normal Cost) and the past (Actuarial Accrued Liability).

Actuarial Gain or Loss (or Experience Gain or Loss) – A measure of the difference between actual experience and that expected based upon the set of Actuarial Assumptions, during the period between the valuation date and the most recent immediately preceding valuation date.

Actuarial Present Value – The dollar value on the valuation date of all benefits expected to be paid to current members based upon the Actuarial Assumptions and the terms of the Plan.

Amortization Payment – That portion of the pension plan appropriation which represents payments made to pay interest on and the reduction of the Unfunded Accrued Liability.

Annual Statement – The statement submitted by the local retirement board to PERAC each year that describes the asset holdings and Fund balances as of December 31 and the transactions during the calendar year that affected the financial condition of the retirement system.

Annuity Reserve Fund – The fund into which total accumulated Member Contributions, including interest, is transferred at the time a member retires, and from which annuity payments are made.

Annuity Savings Fund – The fund in which Member Contributions plus interest credited are held for active members and for former members who have not withdrawn their contributions and are not yet receiving a benefit (inactive members).

Assets – The total value of the investments held by the Plan trust that are for the payment of promised benefits. Employer appropriations and Member Contributions, as well as investment earnings, are added to the Plan trust. Benefit payments and other disbursements are withdrawn from the Plan trust. For valuation purposes, assets are usually measured at market value.

Cost of Benefits – The estimated payment from the pension system for benefits for the fiscal year.

Expense Fund – The fund into which the appropriation for administrative expenses is paid and from which all such expenses are paid.

Funded Ratio – The Actuarial Value of Assets expressed as a percentage of the Actuarial Accrued Liability.

Funding Schedule – The schedule based upon the most recently approved actuarial valuation which sets forth the amount which would be appropriated to the pension system in accordance with Section 22D and Section 22F of M.G.L. Chapter 32.

GASB – Governmental Accounting Standards Board.

Normal Cost – Total Normal Cost is that portion of the Actuarial Present Value of pension plan benefits which is expected to accrue in the current fiscal year. The Employee Normal Cost is the amount of the expected Member Contributions for the current fiscal year. The Employer Normal Cost is the difference between the Total Normal Cost and the Employee Normal Cost.

Pension Fund – The fund into which appropriation amounts as determined by PERAC are paid and from which pension benefits are paid.

Pension Reserve Fund – The fund which shall be credited with all amounts set aside by a system for the purpose of establishing a reserve to meet future pension liabilities. These amounts would include excess interest earnings.

Present Value of Future Benefits – The actuarial present value of the cost to finance benefits payable in the future, discounted to reflect the expected effects of the time value of money and the probabilities of payment.

Special Fund for Military Service Credit – The fund which is credited with amounts paid by the retirement board equal to the amount which would have been contributed by a member during a military leave of absence as if the member had remained in active service of the retirement board. In the event of retirement or a non-job related death, such amount is transferred to the Annuity Reserve Fund. In the event of termination prior to retirement or death, such amount shall be transferred to the Pension Fund.

Total Pension Liability – The portion of the Actuarial Present Value attributable to past service in accordance with the Entry Age cost method as stipulated by GASB Statement Number 67 (GASB 67).

Unfunded Actuarial Accrued Liability – The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets.

SECTION 9 - VALUATION RESULTS BY GROUP

Group	All Others & City of Brockton	Brockton Redevelopment Authority	Brockton Housing Authority	Brockton Area Transit	Total
Summary of Member Data as of January 1, 2020					
Active Members	1,688	6	77	8	1,779
Average Age	46.3	30.7	54.0	45.8	46.6
Average Service	11.2	2.7	14.1	7.0	11.3
Salary	99,072,488	373,632	5,043,960	553,949	105,044,030
Average Salary	58,692	62,272	65,506	69,244	59,047
Retired Members and Survivors	1,051	3	41	2	1,097
Annual Pensions	33,969,543	76,132	1,240,232	80,146	35,366,053
Average Age	75.2	76.2	75.8	71.2	75.2
Disabled Members	192	1	3	0	196
Annual Pensions	9,279,733	26,777	131,763	0	9,438,274
Average Age	67.0	88.8	72.7	0.0	67.2
Inactive Members	690	3	4	2	699
Annuity Savings Fund	4,307,243	38,321	68,828	12,284	4,426,676
Normal Cost as of January 1, 2020					
1.1 Total Normal Cost	14,357,508	38,676	625,507	61,090	15,082,781
1.2 Employee Normal Cost	9,339,551	36,126	448,568	54,233	9,878,478
1.3 Administrative Expenses	719,877	1,939	31,363	3,063	756,242
1.4 Net Employer Normal Cost = 1.1 - 1.2 + 1.3	5,737,834	4,489	208,302	9,920	5,960,545
Actuarial Accrued Liability as of January 1, 2020					
2.1 Active Employees	278,322,971	236,477	16,006,009	765,384	295,330,841
2.2 Retired Members and Survivors	307,474,056	697,537	10,014,288	2,102,813	320,288,694
2.3 Disabled Members	96,778,561	102,842	1,241,265	0	98,122,668
2.4 Inactive Members	4,307,243	38,321	68,828	12,284	4,426,676
2.5 Total = 2.1 + 2.2 + 2.3 + 2.4	686,882,831	1,075,177	27,330,390	2,880,481	718,168,879
Pension Bond Obligation Credit - City of Brockton					
3.1 Credit as of January 1, 2018	194,121,287				194,121,287
3.2 Credit with Interest - 2018 - (-5.2%)	184,026,980				184,026,980
3.3 Credit with Interest - (2019 - 17.92%)	217,004,615				217,004,615
Transfer of Assets Credit - Brockton Area Transit (BAT)					
4.1 Market Value as of January 1, 2018***				1,635,261	1,635,261
Employer contribution - 2018				70,280	70,280
Employee contribution - 2018				62,300	62,300
Transfers - 2018				0	0
Benefit payments - 2018				(79,066)	(79,066)
Administrative expenses - 2018				(2,959)	(2,959)
Interest - 2018 at -5.2%				(86,366)	(86,366)
4.2 Market Value as of January 1, 2019				1,599,450	1,599,450
Employer contribution - 2019				76,834	76,834
Employee contribution - 2019				64,242	64,242
Transfers - 2019				0	0
Benefit payments - 2019				(96,838)	(96,838)
Administrative expenses - 2019				(2,752)	(2,752)
Interest - 2019 at 17.92%				290,185	290,185
4.3 Market Value as of January 1, 2020				1,931,121	1,931,121

SECTION 9 - VALUATION RESULTS BY GROUP

Group	All Others & City of Brockton	Brockton Redevelopment Authority	Brockton Housing Authority	Brockton Area Transit	Total
Actuarial Value of Plan Assets as of January 1, 2020					
5.1 Actuarial Value of Assets					435,232,670
5.2 Actuarial Value of Assets to City (Credit only) and BAT	215,754,779			1,919,999	217,674,778
5.3 Actuarial Value of Assets to All Others	208,918,223	327,019	8,312,650		217,557,892
5.4 Actuarial Value of Assets	424,673,002	327,019	8,312,650	1,919,999	435,232,670
Unfunded Actuarial Accrued Liability (UAAL) as of January 1, 2020					
6.1 UAL = 2.5 - 5.4	262,209,829	748,158	19,017,740	960,482	282,936,209
FY2021 Appropriation					
7.1 Employer Normal Cost, July 1	5,956,027	4,660	216,223	10,297	6,187,207
7.2 Amortization Payment of UAL*	21,675,088	64,856	1,512,043	71,792	23,323,779
7.3 Net 3(8)(c) Transfers	820,499	1,952	26,029	1,520	850,000
7.4 Total = 6.1 + 6.2 + 6.3 + 6.4	28,451,614	71,468	1,754,295	83,609	30,360,986
FY2022 Appropriation					
8.1 Employer Normal Cost, July 1	6,164,488	4,823	223,791	10,657	6,403,759
8.2 Amortization Payment of UAL**	22,772,700	64,692	1,657,357	84,137	24,578,886
8.3 Net 3(8)(c) Transfers	1,158,351	2,756	36,746	2,147	1,200,000
8.4 Total = 8.1 + 8.2 + 8.3 + 8.4	**30,095,539**	**72,271**	**1,917,894**	**96,941**	**32,182,645**
Increase over prior year	5.778%	1.124%	9.326%	15.946%	6.000%
FY2023 Appropriation					
9.1 Employer Normal Cost, July 1	6,380,244	4,992	231,624	11,030	6,627,890
9.2 Amortization Payment of ERI	0	0	0	0	0
9.3 Amortization Payment of UAL	24,354,102	69,184	1,772,449	89,980	26,285,715
9.4 Net 3(8)(c) Transfers	1,158,351	2,756	36,746	2,147	1,200,000
9.5 Total = 9.1 + 9.2 + 9.3 + 9.4	**31,892,697**	**76,932**	**2,040,819**	**103,157**	**34,113,605**
Increase over prior year	5.972%	6.449%	6.409%	6.412%	6.000%

Notes:

1. Actuarial Value of Plan Assets (5.4) is derived from allocation of assets, adjusted for City Pension Obligation Bond adjusted for investment returns through December 31, 2019.

2. FY2022 and FY2023 Appropriation is based on Funding Schedule B-4.

3. 2021 Employer Normal Cost (7.1) is the Employer Normal Cost as of January 1, 2020 (1.4), adjusted for payment timing. 2022 Employer Normal Cost (8.1) is based on 2020 Employer Normal Cost (7.1) increased by 3.5%.

*4. Amortization Payment of UAL (7.3) equals fiscal year 2021 budgeted appropriation (7.5) developed in the January 1, 2018 actuarial valuation less Employer Normal Cost (7.1), amortization payment to ERI (7.2) and Net 3(8)(c) transfers (7.3).

**5. Amortization Payment of UAL (8.3) is the total Amortization Payment of UAL (8.3) allocated to each department in the proportion that the UAL (6.1) less 2019 Amortization Payment of UAL (7.3) bears to the total UAL (6.1) less total Amortization Payment of UAL (8.3).

***6. Adjusted from the amount reported in the 2018 valuation ($1,614,328) to reflect actual cash flow from 2008, less proportionate share of administrative expenses.